

**MEMORANDUM OF UNDERSTANDING**

**BETWEEN**

**THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
OF THE UNITED STATES OF AMERICA**

**AND**

**THE EUROPEAN SPACE AGENCY**

**CONCERNING THE SOLAR ORBITER MISSION**

## **PREAMBLE**

The National Aeronautics and Space Administration of the United States of America (hereinafter referred to as "NASA"),

and

The European Space Agency, an international intergovernmental organization established by the Convention which was opened for signature in Paris, France, on 30 May 1975 and entered into force on 30 October 1980 (hereinafter referred to as "ESA"),

hereinafter jointly referred to as the "Parties",

RECALLING the longstanding cooperation between NASA and ESA in the conduct of space science programs;

RECALLING that ESA has adopted the Solar Orbiter mission within the overall scientific programme on 4 October 2011;

NOTING the exchange of letters establishing an Agreement between ESA and NASA concerning the Definition Phase of the Solar Orbiter mission that was concluded on 29 June 2010;

NOTING that the above-mentioned Agreement superseded an earlier Study-Phase Agreement, concluded by exchange of letters on 17 July 2007, which covered study and follow-on activities for a combination of ESA's Solar Orbiter mission and NASA's Inner Heliospheric Solar Sentinels mission;

CONSIDERING that cooperation on the Solar Orbiter mission between the Parties would enhance the science value of the mission and provide mutual benefits;

HAVE AGREED as follows:

## **ARTICLE 1 – PURPOSE AND OBJECTIVES**

1. The purpose of this Memorandum of Understanding (hereinafter referred to as the “MOU”) is to define the terms and conditions under which the cooperation between the Parties will be conducted within the framework of the Solar Orbiter mission.
2. This MOU sets forth the managerial, technical, and operational interfaces between the Parties that are necessary to ensure continuation of, and compatibility between, their respective activities; defines the roles and responsibilities of the Parties; and identifies the other commitments of the Parties with respect to the Solar Orbiter mission.

## **ARTICLE 2 – RELATED ENTITIES**

1. For the purpose of this MOU, the term “Related Entity” means:
  - (a) a contractor or subcontractor of a Party at any tier;
  - (b) a grantee or any other sponsored entity, or investigator of a Party at any tier; or
  - (c) a contractor or subcontractor of a grantee or any other sponsored entity, or investigator of a Party at any tier.
2. For the purpose of Article 15 (Liability and Risk of Loss), the term “Related Entity” also means:
  - (a) a user or customer of a Party at any tier; or
  - (b) a contractor or subcontractor of a user or customer of a Party at any tier.

It may also include another State or an agency or institution of another State, where such State, agency, or institution is an entity described above or is otherwise involved in the activities undertaken pursuant to this MOU.

The terms “contractor” and “subcontractor” include suppliers of any kind.

3. Without prejudice to the detailed provisions contained in this MOU, each Party will, by contract or otherwise, extend the obligations intended for its Related Entities, as set forth in this MOU, to the said Related Entities.

### ARTICLE 3 – MISSION DESCRIPTION

1. The Solar Orbiter mission will be specifically devoted to solar and heliospheric physics, providing close-up and high-latitude observations of the Sun. The goal of the mission will be to explore the near-Sun environment to improve the understanding of how the Sun determines the environment of the inner solar system and, more broadly, generates the heliosphere itself, and how fundamental plasma physical processes operate near the Sun. This goal addresses Question 2 in ESA's Cosmic Vision programme to understand how the solar system works. Solar Orbiter is specifically designed to identify, by a combination of *in situ* and remote-sensing measurements, the origins and causes of the solar wind, the heliospheric magnetic field, solar energetic particles, transient interplanetary disturbances, and the Sun's magnetic field itself. The Solar Orbiter mission addresses four key questions:

- How and where do the solar wind plasma and magnetic field originate in the corona?
- How do solar transients drive heliospheric variability?
- How do solar eruptions produce energetic particle radiation that fills the heliosphere?
- How does the solar dynamo work and drive connections between the Sun and the heliosphere?

To answer the above science questions, it is essential to make *in situ* measurements of the solar wind's plasma, fields, waves, and energetic particles and imaging/spectroscopic observations close enough to the Sun that they are still relatively unchanged.

2. The Solar Orbiter mission is planned to be a three-axis stabilized spacecraft including European and U.S. provided instruments. The launch on an evolved expendable launch vehicle (EELV) will be followed by a cruise phase including ballistic arcs, deep space manoeuvres by the spacecraft, and planetary Gravity Assist Manoeuvres (GAM) that will place the spacecraft into an inner heliospheric orbit around the Sun. It is planned to place the spacecraft in an optimized transfer trajectory that will lead to an approximately 168-day

science orbit. The orbit is expected to have perihelia ranging from 0.28 to 0.32 Astronomical Units (AU) and aphelia from 0.79 to 0.91 AU. The spacecraft will begin with an in-ecliptic phase of perihelion passes where it is nearly co-rotating with the Sun. The spacecraft will then use multiple Venus GAMs to move its orbital inclination to progressively higher heliolatitudes, reaching 25 degrees by the end of the nominal seven-year prime mission phase and about 34 degrees by the end of any extended mission phase.

Science operations will be conducted predominantly in an encounter-type mode, whereby the full payload will operate only during certain key portions of each science orbit. A subset of the payload (nominally the *in situ* instruments) will operate throughout the entire orbit, within the constraints imposed by mission operations (e.g., telemetry downlink sessions). In addition, synoptic remote-sensing observations will be acquired at a cadence determined by the available telemetry downlink.

The Solar Orbiter mission is an international collaboration comprising many science instruments and suites, including one instrument and one sensor provided by NASA:

- The Heavy Ion Sensor (HIS) sensor, part of the Solar Wind Analyzer instrument, built by Southwest Research Institute; and,
- The Heliospheric Imager for the Solar Orbiter Mission (SoloHI) instrument built by the Naval Research Laboratory.

3. The planned timeline for the Solar Orbiter mission is as follows:

- |  |                        |
|--|------------------------|
| - Launch of Solar Orbiter                      | early 2017             |
| - Start of science operations (in situ)        | 18 months after launch |
| - Start of science operations (remote sensing) | 3.5 years after launch |
| - End of nominal mission                       | 2024                   |

## **ARTICLE 4 – ESA PROGRAMMATIC RESPONSIBILITIES**

To implement this cooperation, ESA will use all reasonable efforts to:

1. design and implement the overall Solar Orbiter mission;
2. define the overall technical, managerial, and interface requirements for the Solar Orbiter mission;
3. design, develop, build, integrate, and verify the Solar Orbiter spacecraft;
4. coordinate the provision of the following instruments:
  - (a) Energetic Particle Detector (EPD);
  - (b) Extreme Ultraviolet Imager (EUI);
  - (c) Magnetometer (MAG);
  - (d) Coronagraph (METIS);
  - (e) Visible Imager & Magnetograph (PHI);
  - (f) Radio and Plasma Waves (RPW);
  - (g) Spectrometer / Telescope for Imaging X-rays (STIX); and
  - (h) Solar Wind Analyzer (SWA).
5. integrate and verify the scientific instruments, listed in Article 4.4 above and Article 5.1 below, on the Solar Orbiter spacecraft;
6. make available to NASA, at a facility in the United States of America to be designated by NASA, the integrated Solar Orbiter spacecraft for launch;
7. support NASA activities relating to integration of the Solar Orbiter spacecraft to the NASA-provided EELV, and to launch site operations;

8. establish and document a Space Debris Mitigation Plan in accordance with the Space Debris Mitigation Guidelines of the Inter-Agency Space Debris Coordination Committee (IADC) of October 15, 2002, as amended;
9. generate the Missile System Pre-launch Safety Package;
10. satisfy the requirements for planetary protection;
11. perform the in-orbit commissioning;
12. control and operate the Solar Orbiter spacecraft; and
13. provide ground station network support during operations.

#### **ARTICLE 5 – NASA PROGRAMMATIC RESPONSIBILITIES**

To implement this cooperation, NASA will use all reasonable efforts to:

1. coordinate the provision of, and deliver to ESA, the SoloHI instrument and the HIS sensor, part of the SWA;
2. support ESA activities relating to integration and verification of the instrument and sensor listed in Article 5.1 above on the Solar Orbiter spacecraft;
3. provide launch, and associated standard launch services, for the Solar Orbiter spacecraft that meet the required launch vehicle performance of a mass of 1800 kilograms and an Earth escape trajectory defined by a Vis-Viva (C3) energy of 20.49 kilometers<sup>2</sup> per second<sup>2</sup> with an orbit declination of 25.78 degrees; and
4. provide ground station network support during launch phase and additional support as agreed between the Parties in accordance with the documents defined in Article 6.3 below.

## **ARTICLE 6 – MANAGEMENT, DOCUMENTATION AND REVIEWS**

1. ESA is responsible for the overall management of the Solar Orbiter mission.
2. The ESA and NASA Project Managers will cooperate in the implementation of the Parties' activities under this MOU. Each of the Parties will manage, in accordance with its own rules and procedures, its activities under this MOU.
3. Management details for the activities described in this MOU will be defined in the Joint Project Implementation Plan (hereinafter referred to as "JPIP"), Experiment Interface Documents (hereinafter referred to as "EIDs"), and the Solar Orbiter Launch Vehicle Interface Control Document (hereinafter referred to as "LVICD"). The JPIP, the EIDs concerning the instruments provided by NASA, and the LVICD will be agreed upon, and revised as necessary, by the ESA and NASA Project Managers and will be in accordance with this MOU. The JPIP, the EIDs, and the LVICD will detail implementation of the undertakings stated in this MOU. These documents may address such items as management and procedural requirements, technical interfaces, a list of required documentation, program implementation schedule, technical reviews, applicable standards, verification, and acceptance.
4. ESA and NASA shall comply with the requirements of NASA Procedural Requirements (NPR) 8715.7, Expendable Launch Vehicle Payload Safety Program, with regard to the design of the flight and ground hardware and launch site processing operations.
5. The Parties will provide to each other complete and timely documentation in accordance with the requirements specified in the JPIP, the EIDs, and the LVICD.
6. The working language for all activities under this MOU, including data and information exchanged between the Parties, will be English.



7. The Project Managers will meet on a regular basis to review the progress of the implementation of the Parties' respective activities under this MOU and to resolve any issues that may have emerged.
8. ESA and NASA will be invited to participate in each other's reviews as appropriate. Reviews will be conducted according to agreed upon ESA/NASA procedures and in compliance with the Solar Orbiter mission schedule.

#### **ARTICLE 7 – RIGHTS IN AND DISTRIBUTION OF DATA**

1. The Parties and all Solar Orbiter investigators (hereinafter referred to as "Mission Investigators") will have access to all data resulting from the mission upon their becoming available at the ESA science operation centre.
2. Following in-orbit commissioning, Mission Investigators retain exclusive data rights for the purpose of calibration and verification for a period of three months after the receipt of the original science telemetry and auxiliary orbit, attitude, and spacecraft status information. Upon delivery of data to the ESA Science Operation Centre, it will be made available to the scientific community at large through the ESA science data archive. Mission Investigators shall have no exclusive first-publication rights. Mission Investigators shall share data between them to enhance the scientific return from the mission. Copies of processed data shall be deposited with the ESA-designated facility and the U.S. National Space Science Data Center (NSSDC).
3. The Parties shall have the right to use the data (processed and unprocessed) at any time, in support of their respective responsibilities.

#### **ARTICLE 8 – TRANSFER OF GOODS AND TECHNICAL DATA**

The Parties are obligated to transfer only those goods and technical data (including software) necessary to fulfill their respective responsibilities under this MOU, in accordance with the following provisions, notwithstanding any other provision of this MOU:

1. All activities of the Parties will be carried out in accordance with applicable laws and regulations pertaining to export control and the control of classified information.
2. The transfer of goods and technical data for the purpose of discharging the Parties' responsibilities with regard to interface, integration, and safety will normally be made without restriction, except as provided in paragraph 1, above.
3. All transfers of export-controlled goods and proprietary or export-controlled technical data are subject to the following provisions:
  - (a) In the event a Party or its Related Entity finds it necessary to transfer export-controlled goods or to transfer proprietary or export-controlled technical data, for which protection is to be maintained, such goods will be specifically identified and such technical data will be marked with a notice.
  - (b) The identification for such goods and the marking of such technical data will indicate that the goods and technical data will be used by the receiving Party or its Related Entities only for the purposes of fulfilling the receiving Party's or Related Entity's responsibilities under this MOU, and that the identified goods and marked technical data will not be disclosed or retransferred to any other entity without the prior written permission of the furnishing Party or its Related Entity.
  - (c) The receiving Party and its Related Entities will abide by the terms of the notice and protect any such identified goods and marked technical data from unauthorized use and disclosure.
  - (d) The Parties to this MOU will cause their Related Entities to be bound by the provisions of this Article related to use, disclosure, and retransfer of identified goods and marked technical data through contractual mechanisms or equivalent measures.
4. All goods and marked proprietary or export-controlled technical data exchanged in the performance of this MOU will be used by the receiving Party or its Related Entity exclusively for the purposes of this MOU. Upon completion of the activities under this MOU, the receiving Party or its Related Entity will return or otherwise dispose of all goods

and marked technical data provided under this MOU, as directed by the furnishing Party or its Related Entity.

## **ARTICLE 9 – INTELLECTUAL PROPERTY**

1. Nothing in this MOU will be construed as granting, either expressly or by implication, to the other Party any rights to, or interest in, any inventions or works of a Party or its Related Entities made prior to the entry into force of, or outside the scope of, this MOU, including any patents (or similar forms of protection in any country) corresponding to such inventions or any copyrights corresponding to such works.
2. Any rights to, or interest in, any invention or work made in the performance of this MOU solely by one Party or any of its Related Entities, including any patents (or similar forms of protection in any country) corresponding to such invention or any copyright corresponding to such work, will be owned by such Party or Related Entity. Allocation of rights to, or interest in, such invention or work between such Party and its Related Entities will be determined by applicable laws, rules, regulations, and contractual obligations.
3. It is not anticipated that there will be any joint inventions made in the performance of this MOU. Nevertheless, in the event that an invention is jointly made by the Parties in the performance of this MOU, the Parties will, in good faith, consult and agree within 30 calendar days as to:
  - (a) the allocation of rights to, or interest in, such joint invention, including any patents (or similar forms of protection in any country) corresponding to such joint invention;
  - (b) the responsibilities, costs, and actions to be taken to establish and maintain patents (or similar forms of protection in any country) for each such joint invention; and
  - (c) the terms and conditions of any license or other rights to be exchanged between the Parties or granted by one Party to the other Party.

4. For any work jointly authored by the Parties, should the Parties decide to register the copyright in such work, they will, in good faith, consult and agree as to the responsibilities, costs, and actions to be taken to register copyrights and maintain copyright protection (in any country).
5. Subject to the provisions of Article 8 (Transfer of Goods and Technical Data) and Article 10 (Release of Results and Public Information), each Party will have an irrevocable royalty-free right to reproduce, prepare derivative works, distribute, and present publicly, and authorise others to do so on its behalf, any copyrighted work resulting from activities undertaken in the performance of this MOU for its own purposes, regardless of whether the work was created solely by, or on behalf of, the other Party or jointly with the other Party.

#### **ARTICLE 10 – RELEASE OF RESULTS AND PUBLIC INFORMATION**

1. The Parties retain the right to release public information regarding their own activities under this MOU. The Parties will coordinate with each other in advance concerning releasing to the public information that relates to the other Party's responsibilities or performance under this MOU.
2. In all media activities, the contributions of each Party to the Solar Orbiter mission will be acknowledged.
3. The Parties will make the final results obtained from the Solar Orbiter mission available to the general scientific community through publication in appropriate journals or by presentations at scientific conferences as soon as possible and in a manner consistent with good scientific practices.
4. The Parties acknowledge that the following data or information does not constitute public information and that such data or information will not be included in any publication or presentation by a Party under this Article without the other Party's prior written permission:

- (a) data furnished by the other Party in accordance with Article 8 (Transfer of Goods and Technical Data) which is export-controlled, classified, or proprietary; or
- (b) information about an invention of the other Party before an application for a patent (or similar form of protection in any country) corresponding to such invention has been filed covering the same, or a decision not to file has been made.

## **ARTICLE 11 – FINANCIAL ARRANGEMENTS**

1. Each Party will bear the costs of discharging its own respective responsibilities under this MOU, including travel and subsistence of its own personnel and transportation of goods and associated documentation, for which it is responsible.
2. The Parties' obligations are subject to the availability of appropriated funds. Should either Party encounter budgetary problems that may affect the activities to be carried out under this MOU, the Party encountering the problems will notify and consult with the other Party in a timely manner and will take appropriate steps to minimise any negative impact of the budgetary problem on the cooperation.

## **ARTICLE 12 – CUSTOMS CLEARANCE AND MOVEMENT OF GOODS**

1. In accordance with applicable laws and regulations, each Party will facilitate free customs clearance and waiver of all applicable customs duties and taxes for goods necessary for the implementation of this MOU. In the event that any customs duties or taxes of any kind are nonetheless levied on such goods, such customs duties or taxes will be borne by the Party related to the authority levying such customs duties or taxes.
2. Each Party will also facilitate the movement of goods into and out of the corresponding territory as necessary to carry out the activities pursuant to this MOU.

### **ARTICLE 13 – EXCHANGE OF PERSONNEL AND ACCESS TO FACILITIES**

1. To facilitate implementation of the activities conducted under this MOU, the Parties may support the exchange of a limited number of personnel (including contractors and subcontractors) from each Party, at an appropriate time and under conditions mutually agreed between the Parties.
2. Access by a Party to the other Party's facilities or property, or to each other's Information Technology (IT) systems or applications, is contingent upon compliance with each other's respective security and safety policies and guidelines including, but not limited to: standards on access to premises, credentials, and facility and IT system application/access.

### **ARTICLE 14 – OWNERSHIP OF EQUIPMENT**

Unless otherwise agreed in writing, each Party will retain ownership of all equipment, including the goods, hardware, software, and associated technical data it provides to the other Party under the terms of this MOU, without prejudice to any individual rights of ownership of the Parties' respective Related Entities. To the extent reasonably feasible and recognizing that equipment sent into space or integrated into the other Party's equipment cannot be returned, each Party agrees to return the other Party's equipment in its possession at the conclusion of activities under this MOU.

### **ARTICLE 15 – LIABILITY AND RISK OF LOSS**

1. For the purposes of this article:
  - (a) The term "damage" means:
    - (i) bodily injury to, or other impairment of health of, or death of, any person;
    - (ii) damage to, loss of, or loss of use of any property;
    - (iii) loss of revenue or profits; or
    - (iv) other direct, indirect, or consequential damage.
  - (b) The term "launch vehicle" means an object or any part thereof intended for launch, launched from Earth, or returning to Earth which carries payloads or persons, or both.
  - (c) The term "payload" means all property to be flown or used on or in a launch vehicle.

- (d) The term "Protected Space Operations" means all activities pursuant to this MOU, including launch vehicle activities and payload activities on Earth, in outer space, or in transit between Earth and outer space. "Protected Space Operations" begin at the entry into force of this MOU and end when all activities done in implementation of this MOU are completed. The term includes, but is not limited to:
- (i) research, design, development, test, manufacture, assembly, integration, operation, or use of launch or transfer vehicles, payloads, or instruments, as well as related support equipment and facilities and services;
  - (ii) all activities related to ground support, test, training, simulation, or guidance and control equipment and related facilities or services.

The term "Protected Space Operations" excludes activities on Earth that are conducted on return from space to develop further a payload's product or process for use other than for the Solar Orbiter mission.

2. The Parties agree that a comprehensive cross-waiver of liability between the Parties and their Related Entities will further participation in space exploration, use, and investment. The cross-waiver of liability will be broadly construed to achieve this objective. The terms of the cross-waiver are set out below.
3. Cross-waiver of liability:
  - (a) Each Party agrees to a cross-waiver of liability pursuant to which each Party waives all claims against the other Party, the other Party's Related Entities, employees of the other Party, or employees of the other Party's Related Entities, based on damage arising out of Protected Space Operations. This cross-waiver will apply only if the person, entity, or property causing the damage is involved in Protected Space Operations and the person, entity, or property damaged is damaged by virtue of its involvement in Protected Space Operations. The cross-waiver will apply to any claims for damage, whatever the legal basis for such claims.
  - (b) Each Party will extend the cross-waiver of liability to its own Related Entities by requiring them, by contract or otherwise, to agree to waive all claims, and require that their Related

Entities waive all claims, against the other Party, the other Party's Related Entities, and employees of the other Party or its Related Entities, based on damage arising out of Protected Space Operations.

- (c) For avoidance of doubt, this cross-waiver of liability includes a cross-waiver for any liability arising from the Convention on International Liability for Damage Caused by Space Objects, which entered into force on 1 September 1972 (hereinafter referred to as the "Liability Convention"), where the person, entity, or property causing the damage is involved in Protected Space Operations and the person, entity, or property damaged is damaged by virtue of its involvement in Protected Space Operations.
- (d) Notwithstanding the other provisions of this Article, this cross-waiver of liability will not be applicable to:
  - (i) claims between a Party and its own Related Entity or among its own Related Entities;
  - (ii) claims made by a natural person, his/her estate, survivors, or subrogees (except when a subrogee is a Party to this MOU or is otherwise bound by the terms of this cross-waiver) for bodily injury, other impairment of health, or death of such natural person; or
  - (iii) claims for Damage caused by willful misconduct;
  - (iv) intellectual property claims;
  - (v) claims for damage resulting from a failure of a Party to extend the cross-waiver of liability to its Related Entities, pursuant to paragraph 3(b) of this Article; or
  - (vi) Claims by a Party arising out of or relating to the other Party's failure to perform its obligations under this MOU.
- (e) Nothing in this Article will be construed to create the basis for a claim or suit where none would otherwise exist.
- (f) In the event of third-party claims which may arise out of, inter alia, the Liability Convention, the Parties will consult promptly on any potential liability, on any apportionment of such liability, and on the defence of such claim.



## **ARTICLE 16 – REGISTRATION, JURISDICTION, AND CONTROL**

ESA will register the Solar Orbiter spacecraft as a space object in accordance with the Convention on the Registration of Objects Launched into Outer Space, done on 12 November 1974. ESA will retain jurisdiction and control over the space object.

## **ARTICLE 17 – MISHAP INVESTIGATION**

In the case of a mishap or mission failure, the Parties will provide assistance to each other in the conduct of any investigation, bearing in mind, in particular, the provisions of Article 8 (Transfer of Goods and Technical Data). In the case of activities that might result in the death of, or serious injury to, persons, or substantial loss of, or damage to, property as a result of activities under this MOU, the Parties will establish a process for investigating each such mishap as part of their program/project-level implementation plans.

## **ARTICLE 18 – AMENDMENT**

This MOU may be amended by written agreement of the Parties.

## **ARTICLE 19 – CONSULTATION AND SETTLEMENT OF DISPUTES**

The Parties will consult with each other promptly when events occur or matters arise that may question the interpretation or implementation of the terms of this MOU. Any dispute in the interpretation or implementation of the terms of this MOU will be referred to the ESA Director of Science and Robotic Exploration and the NASA Associate Administrator for the Science Mission Directorate, or their designees. Any dispute which cannot be resolved at this level will be referred to the Director General of ESA and the Administrator of NASA, or their designees. Failing agreement at that level, the Parties may agree to submit the dispute to an agreed-upon form of dispute resolution.

## **ARTICLE 20 – ENTRY INTO FORCE, DURATION, AND TERMINATION**

1. This MOU will enter into force upon signature by both Parties. It will remain in force until eight years after launch of the Solar Orbiter spacecraft, or until December 31, 2025, whichever is earlier, unless extended by written agreement of the Parties, or terminated in accordance with Article 20.2 below.
2. Either Party may terminate this MOU at any time by giving the other Party at least 12 months written notice of its intent to terminate. In the event of termination, the Parties will endeavour to minimize any negative impact of such termination on the other Party.
3. Termination or expiration of this MOU will not affect a Party's continuing obligations under Article 7 (Rights In and Distribution of Data), Article 8 (Transfer of Goods and Technical Data), Article 9 (Intellectual Property), Article 10 (Release of Results and Public Information), Article 12 (Customs Clearance and Movement of Goods), Article 15 (Liability and Risk of Loss), Article 16 (Registration, Jurisdiction, and Control), Article 17 (Mishap Investigation), and Article 19 (Consultation and Settlement of Disputes), unless otherwise agreed upon by the Parties.
4. Upon entry into force, this MOU will supersede the Agreement between ESA and NASA concerning the Definition Phase of the Solar Orbiter mission that was concluded on 29 June 2010.

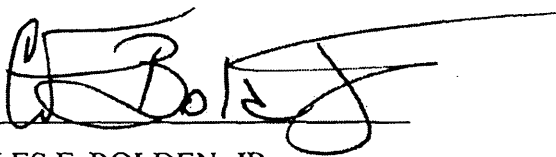
IN WITNESS WHEREOF, the undersigned duly authorised representatives of the Parties have signed this MOU, in two originals, in the English language.

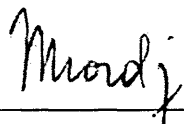
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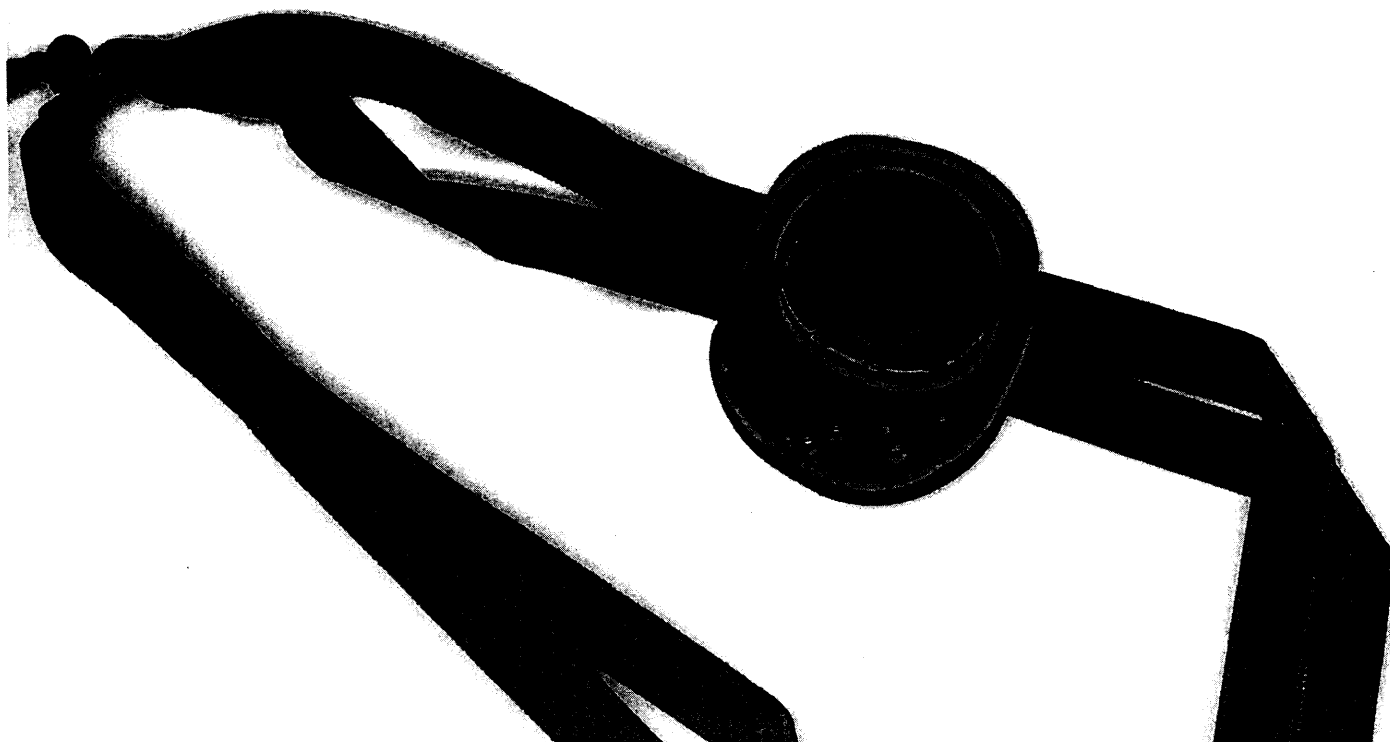
Done at... Paris  
On... 23 February 2012

For the National Aeronautics and Space  
Administration of the United States  
of America

For the European Space Agency

  
CHARLES F. BOLDEN, JR.  
ADMINISTRATOR

  
JEAN-JACQUES DORDAIN  
DIRECTOR GENERAL



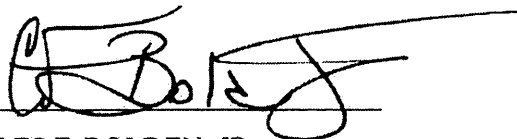
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Done at... Washington, DC  
On... 6 MARCH 2012

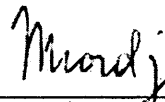
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On... 23 February 2012

For the National Aeronautics and Space  
Administration of the United States  
of America

For the European Space Agency

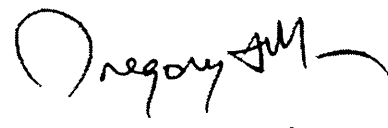


CHARLES F. BOLDEN, JR.  
ADMINISTRATOR



JEAN-JACQUES DORDAIN  
DIRECTOR GENERAL

I certify this to be a true COPY  
of the signed original NASA-ESA  
Solar Orbiter MOU.

  
Gregory Mann

International  
Programs Special